

TrellisWare Technologies Inc.

Experimental License Application

File No: 0679-EX-CN-2022

Narrative for the Troposcatter Link Experiment for the Office of Naval Research (ONR)

Reason for the License Application: Public Interest Statement

The US Navy has an urgent need for reliable beyond line of sight (BLOS) communications in a SATCOM-denied environment. Ship-to-ship and ship-to-shore troposcatter communications, both of which involve mobile troposcatter radios, portrayed in Figure 1, can provide reliable, high throughput (not possible with HF), low latency BLOS communication without the use of space-based or airborne assets (vulnerable to attack, and expensive). For this reason, the Office of Naval Research (ONR), has contracted (contract number N00014-20-C-1075) with TrellisWare Technologies, Inc. (TrellisWare) to develop, build and test Low Power Troposcatter Radio (LPTR) prototypes that can be used in mobile ship-to-ship communications. The LPTR prototypes have a maximum output power of 200 W of Tx power, which is a low power compared to the 1 to 2 kW typical of existing terrestrial troposcatter radios. These LPTR prototypes are an important step towards providing robust ship-to-ship mobile BLOS troposcatter connectivity using the satcom apertures currently installed on Navy ships with only modular upgrades to existing hardware. In a previous over-the-air test, TrellisWare tested the

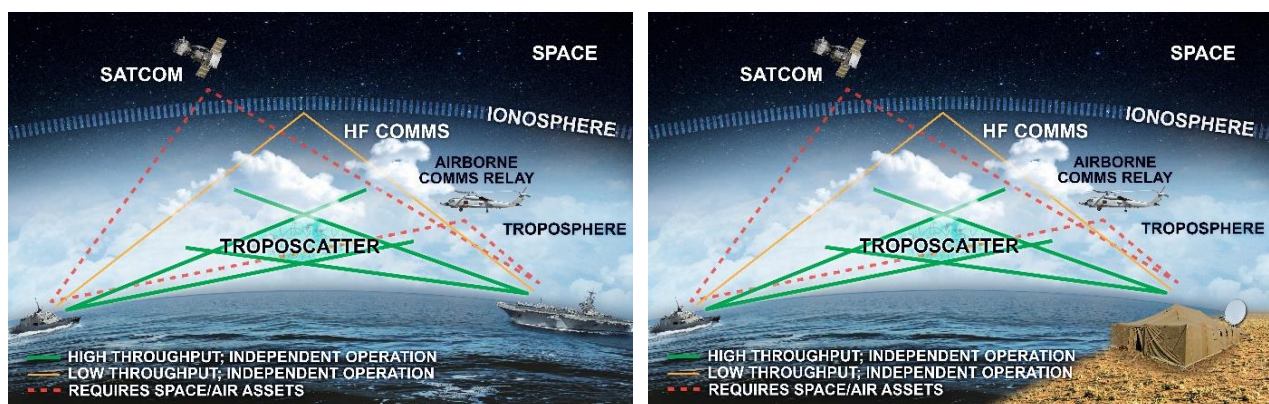


Figure 1: The Navy is interested in troposcatter communications to provide reliable, high throughput, BLOS ship-to-ship (left) and ship-to-shore (right) communications. This license application is in support of achieving that goal.

performance of the LPTR prototypes on a 96-mile link between a stationary site in San Diego, CA and a stationary site in Los Angeles, CA in two tests in December of 2021 and March of 2022 (using FCC

experimental license with call sign WM2XCD, file number 0702-EX-CN-2021). This showed that the LPTR prototypes work well in BLOS stationary communications.

Now that performance between two stationary sites has been proven, the Navy is requiring that the LPTR prototypes be shown to work well between two mobile platforms on a BLOS link to give evidence that the LPTR prototypes will meet the Navy's needs for ship-to-ship mobile BLOS communications. To this end TrellisWare is planning, as part of the on-going Navy contract N00014-20-C-1075, to test two LPTR prototypes, each mounted on a mobile platform (flatbed truck or utility trailer) over an approximately 65-mile link in an uninhabited section of desert in southern California. The LPTR units operate in full duplex mode, which requires the use of two frequencies, one for each of the two directions of transmission between the two mobile platforms. For the frequency full-duplex link, the transmit frequency for one of the LPTR units is taken from 5,930 – 6,109 MHz, and the transmit frequency for the other is taken from 5,850 – 6,361 MHz. TrellisWare plans to perform 5 days of testing in October 2022.

The Navy's requirement to perform over-the-air tests of the frequency full-duplex LPTR prototypes between two mobile platforms is the reason for this application for an FCC license.

The point of contact at the ONR for this contract is Dr. Santanu Das (Office- (703) 588-1036; Mobile- (703) 772-4403; santanu.das@navy.mil).

Request for Temporary Mobile Locations:

TrellisWare has identified two sections of low usage roadway in an uninhabited section of desert in southern California for the experimental link for the over-the-air mobile testing in which the signal travels exclusively over uninhabited desert. Figure 2 shows the location of these two sections of low usage roadway. The first section of roadway is along Chuckwalla Valley Road, which roughly parallels Interstate Highway 10 (I-10) to its south and is bounded by locations A and B on the map in Figure 2. Transmissions from this section will be to the south away from I-10 as illustrated in Figure 3 over exclusively uninhabited land. The second section of roadway is along Evan Hewes Highway, which parallels Interstate Highway 8 to its north and is bounded by locations C and D on the map in Figure 2. Transmission from this section will be to the north, away from I-8 over exclusively uninhabited land.

Frequency Tolerance:

(1) In lieu of frequency tolerance, the occupied bandwidth of the emission shall not extend beyond the band limits set forth in the instant application.

(2) Licensee should be aware that other stations may be licensed on these frequencies and if any interference occurs, the licensee of this authorization will be subject to immediate shut down.

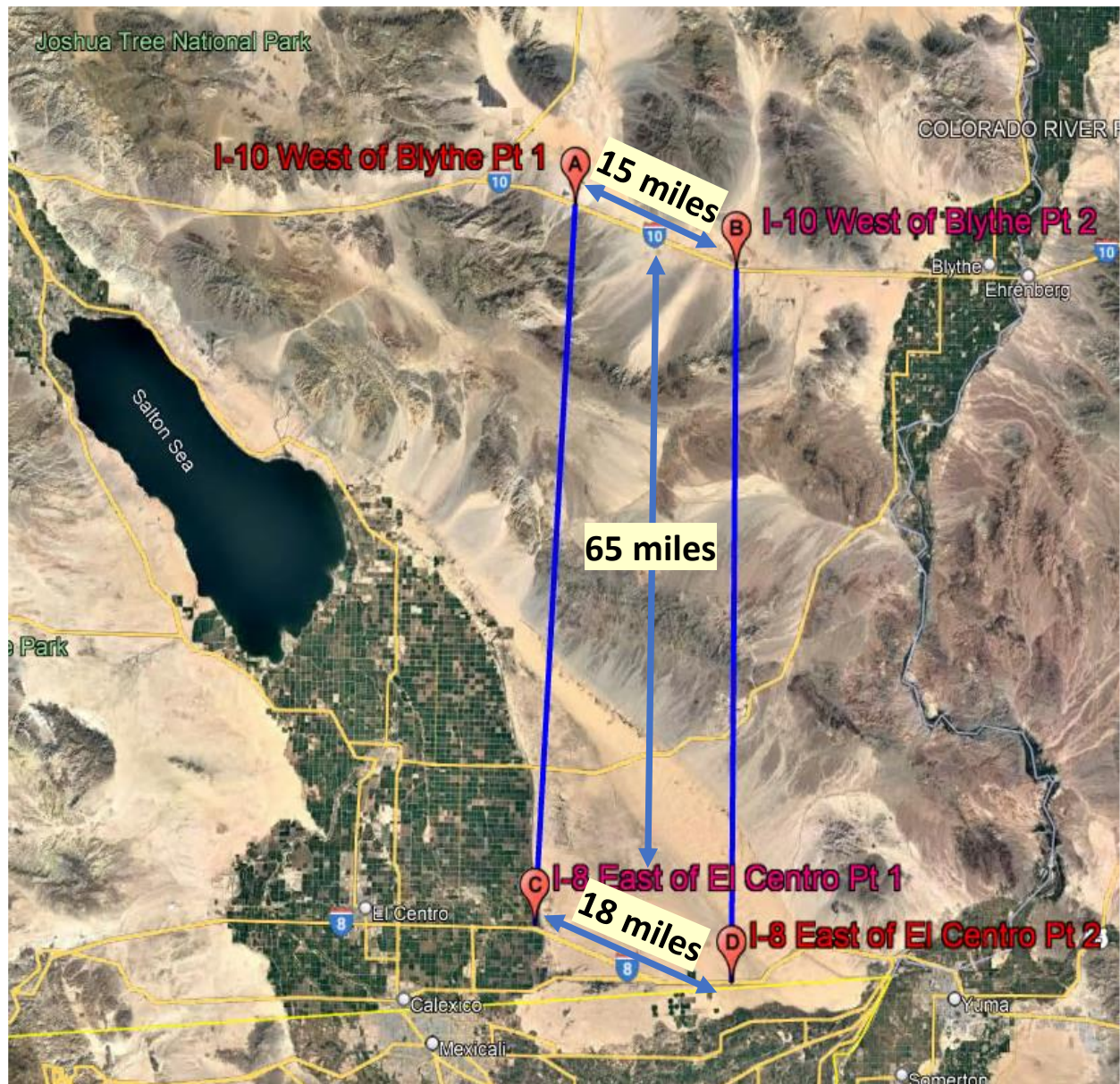


Figure 2: Area of operation. Transmission will be from a first LPTR radio along the path between points A and B south to a second LPTR radio along the path between points C and D; and from that second LPTR radio along the path between points C and D north to the first LPTR radio along the path between points A and B, all over exclusively uninhabited land.

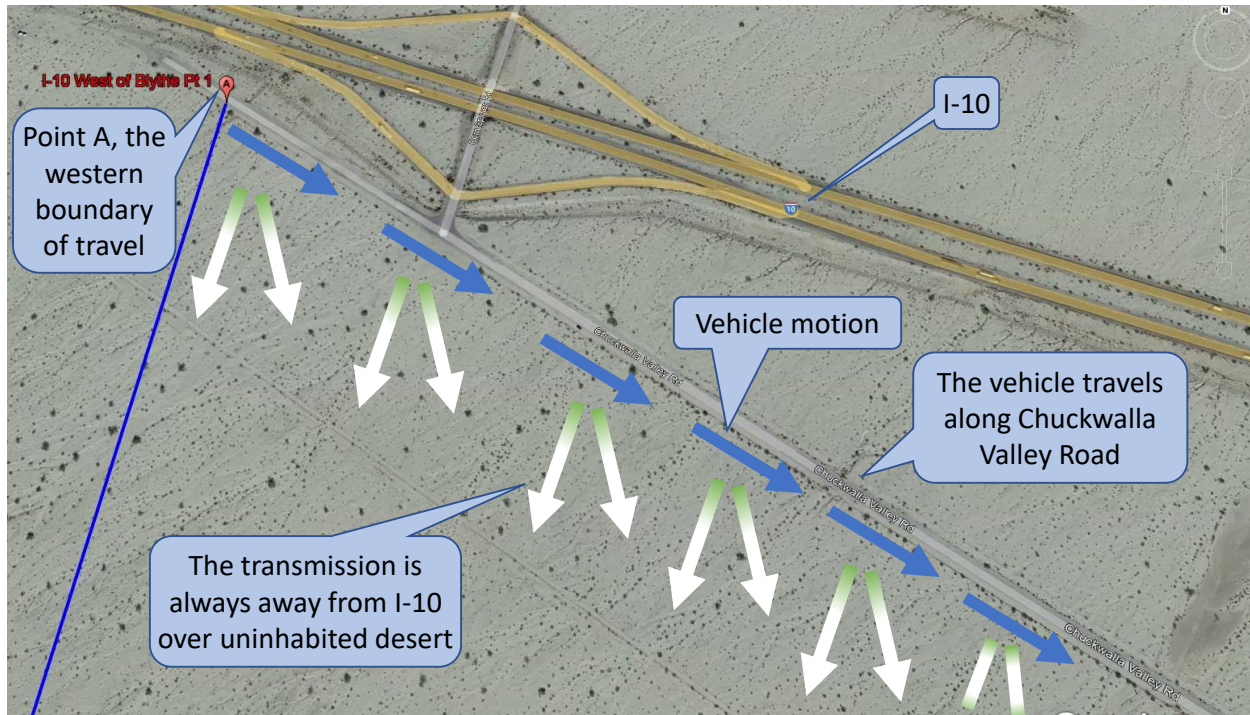


Figure 3: Illustration of the vehicle travelling east from the western boundary of travel along Chuckwalla Valley Road. The transmissions are over uninhabited, barren desert and away from I-10. This is the case along the entire stretch of Chuckwalla Valley Road that is proposed for usage in this over-the-air test. The situation for the transmissions from the south to the north from the proposed section of Evan Hewes Highway is the same, i.e., transmissions are over uninhabited land.

Concept of Operations:

TrellisWare will contact licensees of links that have been identified by the FCC. TrellisWare will 1) alert them to the test dates, 2) see if they would like to have a live call during the power-up of the LPTR transmitters to monitor their links for interference from the experimental link and to provide real-time feedback, and 3) provide them with a “Stop Buzzer Point of Contact”.

TrellisWare anticipates just 5 days of testing in October of 2022. During the over-the-air testing TrellisWare will use the minimum power to close the link. The Navy is interested in using as little transmit power as possible for the troposcatter link.

The directional antennas will be pointed using precision compasses. In advance of powering on the transmitters, TrellisWare will telephone any licensee that has requested a call during power-up on a given frequency so that they can monitor their links for interference and provide live feedback as TrellisWare powers on the transmitters at each site and slowly increases the transmit power, starting at 1 W, until the LPTR signal's robust acquisition signal is observed at the other site, up to an anticipated power level of 50W but no more than a maximum of 200W. During the power bring up, the LPTR units will be stationary. The azimuth of the directional antennas will be controlled to fractions of a degree by the precision pan/tilt units on which they will be mounted. At that point in the process, the over-the-air testing of the LPTR prototypes will begin. The azimuth angles during the mobile testing will be limited to those needed to point at the section of road on which the other LPTR unit is travelling. This is 181.8 ± 14.9 degrees for the north to south direction, and 1.8 ± 14.9 degrees for the south to north direction.

At any point, in the bring-up process or during over-the-air testing, at which interference with a licensed link is reported, TrellisWare will reduce the transmit power until interference is no longer a problem, terminating transmission completely on that frequency if needed.

Stop Buzzer Point of Contact:

Scott Enserink
(562) 595-3570 (mobile)
senserink@trellisware.com

Conclusion:

The US Navy has an urgent need for reliable ship-to-ship mobile BLOS communications in a SATCOM-denied environment. For this reason, the Office of Naval Research (ONR), has contracted with TrellisWare to develop, build and test LPTR prototypes over mobile platforms for operation in the 5,930 MHz – 6,361 MHz band. TrellisWare has identified two sections of roadway in a zero-population-density area for the mobile BLOS over-the-air testing in which the signal travels over uninhabited desert. TrellisWare is seeking an experimental license for this mobile link. TrellisWare plans to perform just 5 days of testing in October of 2022. Prior to the testing TrellisWare will co-ordinate with licensees identified by the FCC whose links may potentially experience interference from the experimental link. During bring-up of the link, TrellisWare will keep the two LPTR radios stationary, as they slowly increase transmit power and communicate real-time during the process with those licensees that desire it. During the testing TrellisWare will use the minimum transmit power to close the link and will have a “Stop Buzzer” point of contact that licensees can contact if they are experiencing interference from the experimental link.

This over-the-air testing will help the ONR, and the Navy take another step in the direction of implementing reliable BLOS troposcatter ship-to-ship and ship-to-shore communications.